

REMARKS

The foregoing amendment amends claims 9, 11, 12 and 14-19. Now, pending in the application are claims 1-12 and 14-25, of which claims 1, 9, 12, 20, 21, 22, 24 and 25 are independent. Claims 22 and 23 are withdrawn from further consideration. The following comments address all stated grounds for rejection and place the presently pending claims, as identified above, in condition for allowance.

Patentable Subject Matter

Claims 20 and 21 are indicated to recite patentable subject matter. Applicants thank the Examiner for passing the claims to allowance.

Elections/Restrictions

The Office Action states that claims 22 and 23 added in the previous amendment are directed to an invention that is independent or distinct from the originally claimed invention because the inventions of claims 22 and 23 and of the previously examined claims are related as combination and sub-combination. In the Office Action, the Examiner constructed that claims 22 and 23 are a non-elected invention and withdrawn from further consideration since the Applicants received actions on the merit for the originally claimed invention.

Claim Objections

Claim 11 is objected to because of minor informalities. In the foregoing claim amendments, Applicants amend claim 11 to address the informalities. In light of the foregoing claim amendments, Applicants request that the Examiner reconsider and withdraw the objection to claim 11.

Rejection of Claims 12 and 14-19 under 35 U.S.C. §101

Claims 12 and 14-19 are rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. In the foregoing claim amendments, Applicants amend claims 12 and 14-19 to recite an apparatus that is statutory subject matter. In light of the foregoing claim amendments, Applicants request that the Examiner reconsider and withdraw the rejection of claims 12 and 14-19 under 35 U.S.C. §101 and pass the claims to allowance.

Rejection of Claims 9-12 and 14-19 under 35 U.S.C. §112

Claims 9-11 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Examiner notes in the Office Action that the limitation “at least about 25 MPa” recited in claim 9 is not in the original disclosure. In the foregoing claim amendments, Applicants amend claim 9 to remove the words “at least” from the recitation. In light of the foregoing claim amendments, Applicants request that the Examiner reconsider and withdraw the rejection of claims 9-11 under 35 U.S.C. §112, first paragraph, and pass the claims to allowance.

Claims 12 and 14-19 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. In the foregoing claim amendments, Applicants amend claims 12 and 14-19 to recite an apparatus in order to clarify the subject matter of the claims. In light of the foregoing claim amendments, Applicants request that the Examiner reconsider and withdraw the rejection of claims 12 and 14-19 under 35 U.S.C. §112, second paragraph, and pass the claims to allowance.

Rejection of Claims 1, 4 and 8-10 under 35 U.S.C. §103

Claims 1, 4, 8-10 are rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68. Applicants respectfully traverse the rejection for the following reasons.

Independent claim 1 is directed to an apparatus for warming-up a fuel cell. The apparatus includes a high-pressure tank for storing hydrogen gas that can be discharged at the

pressure of about 25 MPa, and a hydrogen-occlusion alloy tank having a hydrogen-occlusion alloy. The hydrogen discharged from the high-pressure tank is provided to the hydrogen-occlusion alloy tank and the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas into the hydrogen-occlusion alloy tank is transferred to the fuel cell to thereby warm-up the fuel cell. Claims 4 and 8 depend from claim 1. Independent claim 9 is a process claim that parallels claim 1. Claim 10 depends from claim 9.

Applicants submit that Okada and JP 60-68 do not teach or suggest that *the hydrogen discharged from the high-pressure tank is provided to the hydrogen-occlusion alloy tank, and the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas into the hydrogen-occlusion alloy tank is transferred to the fuel cell to thereby warm-up the fuel cell*, as recited in claims 1 and 9. The Examiner recognizes that Okada does not teach or suggest this feature of the claimed invention. See the Office Action, page 8, lines 1-4. JP 60-68 is cited by the Examiner to compensate for the deficiencies of the Okada reference.

JP 60-68 teaches a system including a fuel cell (15), a first metal hydride tank (4) and a second metal hydride tank (10). The first metal hydride tank provides hydrogen to the second metal hydride tank, and the heat generated in the second metal hydride tank is transferred to the fuel cell. In the JP 60-68 reference, however, the second metal hydride tank does not receive hydrogen from a high-pressure hydrogen tank, as recited in the claimed invention.

Moreover, there is no motivation to combine the teachings of the Okada and JP 60-68 references. Okada teaches a heat transfer from the exhaust of the fuel cell (1) to the hydrogen storage metal alloy (4). In contrast, JP 60-68 teaches a heat transfer from the second metal hydride (10) to the fuel cell (15). Since these two references teach opposite heat transfer directions to address different problems, those of ordinary skill in the art would not be motivated to combine the teachings of the references.

Additionally, Applicants respectfully submit that Okada and JP 60-68 do not teach or suggest that *the pressure of the hydrogen discharged from (claim 1) or stored in (claim 9) the high-pressure tank is about 25 MPa*, as recited in claims 1 and 9. The Examiner recognizes in the Office Action that Okada does not teach or suggest this feature of the claimed invention. See

the Office Action, page 8, lines 1-4. In order to compensate for the deficiencies of the Okada reference, the Examiner takes Official Notice that the high-pressure hydrogen tank is commercially available in a variety of sizes and pressures in the hydrogen supply art. See the Office Action, page 9, lines 15-16. The Examiner also asserts that the use of the high-pressure hydrogen tank having the discharging pressure of about 25 MPa is obvious to those of ordinary skill in the art. See the Office Action, page 9, lines 17-20.

Applicants submit that although the high-pressure hydrogen tank may be available in the art at the time the present invention was made, the patentable feature of the claimed invention that about 25 MPa hydrogen tank is used to provide hydrogen to the hydrogen-occlusion alloy tank and to generate heat in the hydrogen-occlusion alloy tank to warm-up the fuel cell is not obvious to those of ordinary skill in the art. Applicants therefore request the Examiner to provide documentary evidence supporting the Examiner's position.

In light of the foregoing arguments, Applicants submit that the subject matter recited in claims 1 and 9 is not obvious over Okada and JP 60-68. Claims 4, 8 and 10, which depend upon one of claims 1 and 9, are not rendered obvious over the cited prior art references. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 1, 4 and 8-10 under 35 U.S.C. §103, and pass the claims to allowance.

Rejection of Claims 2, 3, 5 and 11 under 35 U.S.C. §103

Claims 2, 3, 5 and 11 are rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 ("Okada"), in view of JP 60-68, and further in view of U.S. Patent No. 6,350,535 ("Kralick"). See the Office Action, page 16, lines 1-4. Applicants respectfully traverse the rejection for the following reasons.

Claims 2, 3 and 5 depend from claim 1 and add separate and patentable limitations to claim 1. Claim 11 depends from claim 9 and adds separate and patentable limitations to claim 9. Kralick is cited by the Examiner to provide teachings for the limitations recited in dependent claims 2, 3, 5 and 11. Kralick teaches a mist evaporation system for fuel cell hydration using the exhaust of the fuel cell. The Kralick reference, however, does not teach that *the hydrogen*

discharged from the high-pressure tank is provided to the hydrogen-occlusion alloy tank, and the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas into the hydrogen-occlusion alloy tank is transferred to the fuel cell to thereby warm-up the fuel cell, as recited in claims 1 and 9. In light of this, Applicants submit that the subject matter recited in claims 1 and 9 is not obvious over Okada, JP 60-68 and Kralick. Claims 2, 3, 5 and 11, which depend upon one of claims 1 and 9, are not rendered obvious over the cited prior art references. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 2, 3, 5 and 11 under 35 U.S.C. §103, and pass the claims to allowance.

Rejection of Claims 6 and 7 under 35 U.S.C. §103

Claims 6 and 7 are rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68, and further in view of U.S. Patent No. 6,406,808 (“Pratt”). See the Office Action, page 17, lines 8-11. Applicants respectfully traverse the rejection for the following reasons.

Claims 6 and 7 depend from claim 1 and add separate and patentable limitations to claim 1. Pratt is cited by the Examiner to provide teachings for the limitations recited in dependent claims 6 and 7. The Pratt reference relates to thermal management of a fuel cell system, and teaches that cell waste heat is transferred to the fuel storage container. The Pratt reference, however, does not teach that *the hydrogen discharged from the high-pressure tank is provided to the hydrogen-occlusion alloy tank, and the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas into the hydrogen-occlusion alloy tank is transferred to the fuel cell to thereby warm-up the fuel cell*, as recited in claims 1 and 9. In light of this, Applicants submit that the subject matter recited in claim 1 is not obvious over Okada, JP 60-68 and Pratt. Claims 6 and 7, which depend upon claim 1, are not rendered obvious over the cited prior art references. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 6 and 7 under 35 U.S.C. §103, and pass the claims to allowance.

Rejection of Claims 12, 14 15, 18 and 19 under 35 U.S.C. §103

Claims 12, 14, 15, 18 and 19 are rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68, U.S. Patent No. 6,350,535 (“Kralick”) and U.S. Patent No. 4,826,741 (“Aldhart”). See the Office Action, page 10, lines 1-4. Applicants respectfully traverse the rejection for the following reasons.

Independent claim 12 is directed to an apparatus for warming-up a fuel cell. The apparatus has a configuration of warming-up the fuel cell by a heat generated during the occlusion of hydrogen in a hydrogen-occlusion alloy. The cooling water of the fuel cell passes outside of a tank containing the hydrogen-occlusion alloy and is heated by the heat generated for warming-up the fuel cell. The apparatus includes a hydrogen-discharge means for discharging hydrogen having been occluded in the hydrogen-occlusion alloy and supplying the discharged hydrogen to the fuel cell as fuel. Claims 14, 15, 18 and 19 depend from claim 12.

Applicants submit that Okada, JP 60-68, Kralick and Aldhart do not teach or suggest *a configuration of warming-up the fuel cell by a heat generated during the occlusion of hydrogen in a hydrogen-occlusion alloy, wherein the cooling water for cooling the fuel cell passes outside of a tank containing the hydrogen-occlusion alloy and is heated by the heat generated for warming-up the fuel cell*, as recited in claim 12. The Examiner recognizes in the Office Action that Okada does not teach or suggest this feature of the claimed invention. See the Office Action, page 12, lines 1-9. JP 60-68, Kralick and Aldhart are cited by the Examiner to compensate for the deficiencies of the Okada reference.

JP 60-68 teaches a system including a fuel cell (15), a first metal hydride tank (4) and a second metal hydride tank (10). The first metal hydride tank provides hydrogen to the second metal hydride tank, and the heat generated in the second metal hydride tank is transferred to the fuel cell. The JP 60-68 reference, however, does not teach that a fuel cell is warmed up by the heat generated during the occlusion of hydrogen in a hydrogen-occlusion alloy, wherein the cooling water for cooling the fuel cell passes outside of a tank containing the hydrogen-

occlusion alloy and is heated by the heat generated for warming-up the fuel cell, as recited in the claimed invention.

The Kralick reference is cited by the Examiner to provide teachings for the water as a heat exchange medium. The Examiner also cites the Aldhart reference to provide teachings for the limitation that the cooling water passes outside of the hydrogen-occlusion alloy tank to the fuel cell, as recited in claim 12. These references, however, do not teach a heat transfer from the hydrogen-occlusion alloy tank to the fuel cell, as recited in the claimed invention.

Moreover, there is no motivation to combine the teachings of the Okada, JP 60-68, Kralick and Aldhart references. Okada teaches a heat transfer from the exhaust of the fuel cell (1) to the hydrogen storage metal alloy (4). In the Kralick reference, heat is transferred from the fuel cell (22) to the reactant gas (15). In the Aldhart reference, heat is transferred from the fuel cell (20C) to the hydride container (70). In contrast, JP 60-68 teaches a heat transfer from the second metal hydride (10) to the fuel cell (15). These references teach opposite heat transfer directions to address different problems, those of ordinary skill in the art would not be motivated to combine the teachings of the references.

In light of the foregoing arguments, Applicants submit that the subject matter recited in claim 12 is not obvious over Okada, JP 60-68, Kralick and Aldhart. Claims 14, 15, 18 and 19, which depend upon claim 12, are not rendered obvious over the cited prior art references. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 12, 14, 15, 18 and 19 under 35 U.S.C. §103, and pass the claims to allowance.

Rejection of Claims 16 and 17 under 35 U.S.C. §103

Claims 16 and 17 are rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68, U.S. Patent No. 6,350,535 (“Kralick”) and U.S. Patent No. 4,826,741 (“Aldhart”), and further in view of U.S. Patent No. 6,406,808 (“Pratt”). See the Office Action, page 15, lines 1-5. Applicants respectfully traverse the rejection for the following reasons.

Claims 16 and 17 depend from claim 12, and add separate and patentable limitations to claim 12. Pratt is cited by the Examiner to provide teachings for the limitations recited in dependent claims 16 and 17. The Pratt reference teaches that cell waste heat is transferred to the fuel storage container. The Pratt reference, however, does not teach warming-up a fuel cell using heat generated during the occlusion of hydrogen in the hydrogen-occlusion alloy, wherein cooling water for cooling the fuel cell passes outside of a tank containing the hydrogen-occlusion alloy and is heated by the heat generated for warming-up the fuel cell, as recited in claim 12. In light of this, Applicants submit that the subject matter recited in claim 12 is not obvious over Okada, JP 60-68, Kralick, Aldhart and Pratt. Claims 16 and 17, which depend upon claim 12, are not rendered obvious over the cited prior art references. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claims 16 and 17 under 35 U.S.C. §103, and pass the claims to allowance.

Rejection of Claim 24 under 35 U.S.C. §103

Claim 24 is rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68 and U.S. Patent No. 6,240,971 (“Monette”). See the Office Action, page 18, lines 4-7. Applicants respectfully traverse the rejection for the following reasons.

Claim 24 is directed to an apparatus for warming-up a fuel cell. The apparatus includes a high-pressure tank formed of a fiber reinforced plastic for storing hydrogen gas, and a hydrogen-occlusion alloy tank having a hydrogen-occlusion alloy. The apparatus includes hydrogen-transferring means which transfers hydrogen discharged from the high-pressure tank to the hydrogen-occlusion alloy in the hydrogen-occlusion alloy tank. The apparatus further includes heat-transmitting means which transmits the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas transferred by the hydrogen-transferring means into the hydrogen-occlusion alloy tank to the fuel cell.

Applicants submit that Okada, JP 60-68 and Monette do not teach or suggest *hydrogen-transferring means which transfers hydrogen discharged from the high-pressure tank to the*

hydrogen-occlusion alloy in the hydrogen-occlusion alloy tank, and heat-transmitting means which transmits the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas transferred by the hydrogen-transferring means into the hydrogen-occlusion alloy tank to the fuel cell, as recited in claim 24. The Examiner recognizes that Okada does not teach or suggest this feature of the claimed invention. See the Office Action, page 20, lines 1-4. JP 60-68 and Monette are cited by the Examiner to compensate for the deficiencies of the Okada reference.

As discussed above, in the JP 60-68 reference, the second metal hydride tank does not receive hydrogen from a high-pressure hydrogen tank, as recited in the claimed invention.

The Monette is cited by the Examiner to provide teachings for the limitation that the high-pressure hydrogen tank is formed of a fiber reinforced plastic (FRP). The Monette reference teaches that fiber reinforced composites are useful in the construction of storage tanks. The Monette reference, however, does not relate to a fuel cell system. The Monette reference does not teach a hydrogen supply from the high-pressure hydrogen tank to the hydrogen-occlusion alloy tank, and a heat transfer from the hydrogen-occlusion alloy tank to the fuel cell, as recited in the claimed invention.

Moreover, there is no motivation to combine the teachings of the Okada, JP 60-68 and Monette references. Okada teaches a heat transfer from the exhaust of the fuel cell (1) to the hydrogen storage metal alloy (4). In contrast, JP 60-68 teaches a heat transfer from the second metal hydride (10) to the fuel cell (15). These references teach opposite heat transfer directions. The Monette reference does not teach heat transfer between a fuel cell and a hydrogen occlusion tank. Since the cited references address different problems, those of ordinary skill in the art would not be motivated to combine the teachings of the references.

In light of the foregoing arguments, Applicants submit that the subject matter recited in claim 24 is not obvious over Okada, JP 60-68 and Monette. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claim 24 under 35 U.S.C. §103, and pass the claim to allowance.

Rejection of Claim 25 under 35 U.S.C. §103

Claim 25 is rejected under 35 U.S.C. §103(a) as being obvious over WO00/58529, which is equivalent to U.S. Patent No. 6,835,490 (“Okada”), in view of JP 60-68, U.S. Patent No. 6,240,971 (“Monette”) and JP 90061401. See the Office Action, page 22, lines 3-6. Applicants respectfully traverse the rejection for the following reasons.

Claim 25 is directed to an apparatus for warming-up a fuel cell. The apparatus includes a high-pressure tank for storing hydrogen gas, and a hydrogen-occlusion alloy tank formed of an aluminum alloy and having a hydrogen-occlusion alloy accommodated therein. The aluminum alloy of the hydrogen-occlusion alloy tank has higher heat conductivity than the high-pressure tank. The apparatus also includes hydrogen-transferring means which transfers hydrogen discharged from the high-pressure tank to the hydrogen-occlusion alloy in the hydrogen-occlusion alloy tank. The apparatus further includes heat-transmitting means which transmits the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas transferred by the hydrogen-transferring means into the hydrogen-occlusion alloy tank to the fuel cell.

Applicants submit that Okada, JP 60-68, Monette and JP 90061401 do not teach or suggest *hydrogen-transferring means which transfers hydrogen discharged from the high-pressure tank to the hydrogen-occlusion alloy in the hydrogen-occlusion alloy tank, and heat-transmitting means which transmits the heat generated in the hydrogen-occlusion alloy during the course of storing the hydrogen gas transferred by the hydrogen-transferring means into the hydrogen-occlusion alloy tank to the fuel cell*, as recited in claim 25. The Examiner recognizes that Okada does not teach or suggest this feature of the claimed invention. See the Office Action, page 24, lines 1-7. JP 60-68, Monette and JP 90061401 are cited by the Examiner to compensate for the deficiencies of the Okada reference.

As discussed above, in the JP 60-68 reference, the second metal hydride tank does not receive hydrogen from a high-pressure hydrogen tank, as recited in the claimed invention.

The Monette and JP 90061401 references are cited by the Examiner to provide teachings for the limitations that the high-pressure hydrogen tank is formed of a fiber reinforced plastic (FRP), and that the hydrogen-occlusion alloy tank is formed of an aluminum alloy, respectively. The Monette and JP 90061401 references, however, do not relate to a fuel cell system. The Monette and JP 90061401 references do not teach a hydrogen supply from the high-pressure hydrogen tank to the hydrogen-occlusion alloy tank, and a heat transfer from the hydrogen-occlusion alloy tank to the fuel cell.

Moreover, there is no motivation to combine the teachings of the Okada, JP 60-68, Monette and JP 90061401 references. Okada teaches a heat transfer from the exhaust of the fuel cell (1) to the hydrogen storage metal alloy (4). In contrast, JP 60-68 teaches a heat transfer from the second metal hydride (10) to the fuel cell (15). These references teach opposite heat transfer directions. The Monette and JP 90061401 references do not teach heat transfer between a fuel cell and a hydrogen tank. Since the cited references address different problems, those of ordinary skill in the art would not be motivated to combine the teachings of the references.

In light of the foregoing arguments, Applicants submit that the subject matter recited in claim 25 is not obvious over Okada, JP 60-68, Monette and JP 90061401. Applicants therefore request that the Examiner reconsider and withdraw the rejection of claim 25 under 35 U.S.C. §103, and pass the claim to allowance.

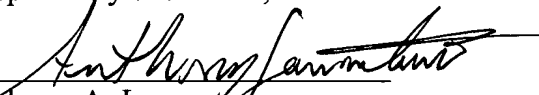
Conclusion

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

By



Anthony A. Laurentano

Registration No.: 38,220

LAHIVE & COCKFIELD, LLP

28 State Street

Boston, Massachusetts 02109

(617) 227-7400

(617) 742-4214 (Fax)

Attorney/Agent For Applicant